1246311

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

November 05, 2004

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: ***60/508,024***
FILING DATE: ***October 01, 2003***
RELATED PCT APPLICATION NUMBER: ***PCT/US04/32322***

Certified by

Jon W Dudas

Acting Under Secretary of Commerce
for Intellectual Property
and Acting Director of the U.S.
Patent and Trademark Office

17707 U.S. PTO
10/01/03

Please type a plus sign (+) inside this box → +

PTO/SB/16 (5-03)
Approved for use through 04/30/2003. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

15535 U.S. PTO
60/508024
10/01/03

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
R bert James	DONOHUE	Clayton, North Carolina

☐ *Additional inventors are being named on the____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

HEAT FORM COILING DEVICE

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☐ Customer Number 29540 → *Place Customer Number Bar Code Label here*

OR *Type Customer Number here*

☒ Firm or Individual Name	John F. Gulbin				
Address	PITNEY HARDIN KIPP & SZUCH LLP				
Address	685 Third Avenue				
City	New York	State	NY	ZIP	10017-4024
Country	US	Telephone	212.297.5800	Fax	212.682.3485

ENCLOSED APPLICATION PARTS ***(check all that apply)***

☒ Specification *Number of Pages* 9 ☐ CD(s), Number

☒ Drawing(s) *Number of Sheets* 3 ☐ Other (specify)

☐ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

☒ A check or money order is enclosed to cover the filing fees

☒ The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number 50-1145

☐ Payment by credit card. Form PTO-2038 is attached.

FILING FEE AMOUNT ($) $160.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract numl

EV091972025US

Respectfully submitted,

SIGNATURE John F. Gulbin

Date 10/1/03

TYPED or PRINTED NAME John F. Gulbin

REGISTRATION NO. 33,180
(if appropriate)
Docket Number: 078305.106035

TELEPHONE 212.297.5833

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

HEAT FORM COILING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to plastic tubing and, more particularly, to a method for forming plastic tubing into coils and to a coiling system for practicing the method.

2. Description of the Prior Art

In the prior art, plastic tubing, such as tubing made from polyvinyl chloride (PVC), has been placed into coiled form by wrapping or coiling the tubing onto a mandrel, which may either be made of ultra-high molecular weight (UHMW) polyethylene, or have a sleeve or covering of that material, and by placing the mandrel into an oven for a suitable length of time to heat-form the tubing into a coil. Not only is this prior-art method inefficient, but it is also very labor-intensive and prohibitively expensive.

As a consequence, there has long been sought a more economical and straightforward method for producing a coil from a length of plastic tubing. Such a method is made

possible with the use of the coiling system of the present invention.

SUMMARY OF THE INVENTION

Accordingly, the present invention is a coiling system for continuously forming coiled plastic tubing in desired lengths. The present invention also encompasses a method for forming lengths of coiled plastic tubing. The method may be practiced using the coiling system described below.

The coiling system comprises a main tube shaft which is rotated at a desired rate by a main drive shaft driven by a variable-speed motor. The plastic tubing is supplied either directly from an extruder or from a reel of previously extruded tubing, and is fed toward the main tube shaft through a gap in a tube guide. The gap is an opening cut at an oblique angle through the tube guide to direct the plastic tubing at an angle suitable for winding it continuously onto the main tube shaft in the form of a helix.

The coiled tubing traverses along the main tube shaft as it is wound thereabout. At one point downstream from the tube guide, a heat source is directed toward the coiled tubing, softening it as it traverses thereby. Further

downstream from the heat source is a cool-air source, which is directed toward the coiled tubing and sets it into its coiled form. Subsequently, the coiled tubing is cut into desired lengths by a cutter downstream from the cool-air source.

The present invention will now be described in more complete detail with frequent reference being made to the figures identified below.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic plan view of the coiling system of the present invention;

Figures 2A, 2B and 2C illustrate the construction of the main tube shaft used on the coiling system; and

Figures 3A and 3B are plan and edge views, respectively, of the tube guide used on the coiling system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to Figure 1, a schematic plan view of the coiling system 10 of the present invention, the coiling system 10 comprises a motor 12 and a speed controller 14 therefor. Motor 12 may be set, using speed controller 14, to rotate at speeds in a range from 1 RPM (rotation per minute) to 1000 RPM.

Motor 12 is connected to a main drive shaft 16 by means of coupling 18. Main drive shaft 16 is turned by motor 12 within bearings 20, and passes through a support block 22. A main tube shaft 24 is threadingly connected to main drive shaft 16 beyond support block 22 from motor 12 and bearings 20, and is the component of coiling system 10 on which the tubing is actually coiled.

A more detailed view of main tube shaft 24 is provided in Figures 2A through 2C. Main tube shaft 24 may be seen to have four sections, and has a male threaded member 26 by which it is connected to main drive shaft 16 in Figure 1. In a first section 28, main tube shaft 24 has a first diameter which includes a first sleeve 30 of UHMW polyethylene, the purpose of which will be described below.

In a second section 32, main tube shaft 24, which, for example, is made of aluminum or steel, tapers from the first diameter to a smaller second diameter. In a third section 34, main tube shaft 24 is of the second diameter which includes a second sleeve 36 of UHMW polyethylene. The purpose of the second sleeve 36 will also be described below.

Finally, in a fourth section 38, which is threadingly connected to the rest of main tube shaft 24 to enable second sleeve 36 to be removed and replaced, main tube shaft 24 is of the second diameter. As in the second section 32, the main tube shaft 24 has a metal surface in the fourth section 38.

Turning now, back to Figure 1, main tube shaft 24 passes through tube guide 40 beyond motor 12 and bearings 20. Tube guide 40 is shown in Figures 3A and 3B, the former being a plan view and the latter being a view looking down on the top edge in Figure 3A.

In Figure 3A, tube guide 40 has a circular hole 42. Extending more or less radially upward from hole 42 is a gap 44. In Figure 3B, gap 44 may be seen to provide an opening at an oblique angle relative to the plane of the tube guide 40. The gap 44 makes an angle of 158° with the plane of tube guide 40, an angle found empirically to provide the best results for forming coils of tubing having an outside diameter of 0.125 inch and a wall thickness of 30 mil, typical dimensions of the tubing that may be coiled with the present invention.

Turning, again, back to Figure 1, gap 44 in tube guide 40 is directly above main tube shaft 24, which passes through hole 42 in tube guide 40. Typically, hole 42 has a diameter that is 0.25 inch larger than first diameter of first section 28 of main tube shaft 24, providing a clearance of 0.125 inch between the tube guide 40 and the main tube shaft 24 at the hole 42.

Coiling system 10 may be used either downstream from an extruder used to produce plastic tubing or off-line. In the latter situation, the plastic tubing has been previously extruded and wound onto a spool or reel, from which it may be fed to the coiling system 10. In either case, various pulleys and tensioners would be used to feed the tubing to the coiling system 10, as would be readily clear to those of ordinary skill in the art.

Referring again to Figure 1, in either case plastic tubing, not shown in the figure, is fed between support block 22 and tube guide 40 and through gap 44. Motor 12 rotates main drive shaft 16 and main tube shaft 24 in the direction indicated by the arrows therearound, pulling the tubing through the gap 44 at the oblique angle the gap 44 makes with the plane of the tube guide 40, so that it is

continually wound onto the main tube shaft 24 in the form of a helix. In this regard, first sleeve 30 of UHMW polyethylene assists in the winding of the tubing by virtue of the frictional forces acting therebetween. These frictional forces are greater than those that would act between the tubing and the bare metallic surface of the second portion 32 of the main tube shaft 24.

A heat source 46, which may be a precise heat gun, such as a Steinel 3002 LCD electronic hot air gun, or an oven, heats the coiled tubing to a temperature typically in a range from 400°F to 700°F, the exact temperature used depending on the composition of the tubing being coiled. As the main tube shaft 24 rotates, the coiled plastic tubing traverses therealong past the heat source 46 and beyond.

Downstream from the heat source 46, that is, to its left in Figure 1, is a cool-air source 48, such as one having a vortex cooling tube. The cool-air source 48 sets the previously heated tubing into coiled form. It will be recalled that second portion 32 of main tube shaft 24 tapers gradually from a first diameter to a second diameter which is slightly smaller. This ensures that the coiled tube will be readily removable from the main tube shaft 24 downstream

from the cool-air source 48 as the coil will have a slightly larger diameter than the shaft 24 at that point.

Further downstream along main tube shaft 24, additional sources of compressed air may be directed at the coiled tubing to further cool and set it in its coiled form.

It will be further recalled that third section 34 of main tube shaft 24 has a second sleeve 36 of UHMW polyethylene. Adjacent to the second sleeve 36 is a cutter 50 having a blade 52. The cutter 50 cuts the coiled tubing at intervals to produce desired lengths thereof. Blade 52 cuts the coiled tubing against second sleeve 36, which is much softer than a metal surface and prevents the blade 52 from wearing out too quickly.

Finally, downstream beyond the cutter 50 is an air ejector 54, or similar device, to remove the cut lengths of coiled tubing from the main tube shaft 24.

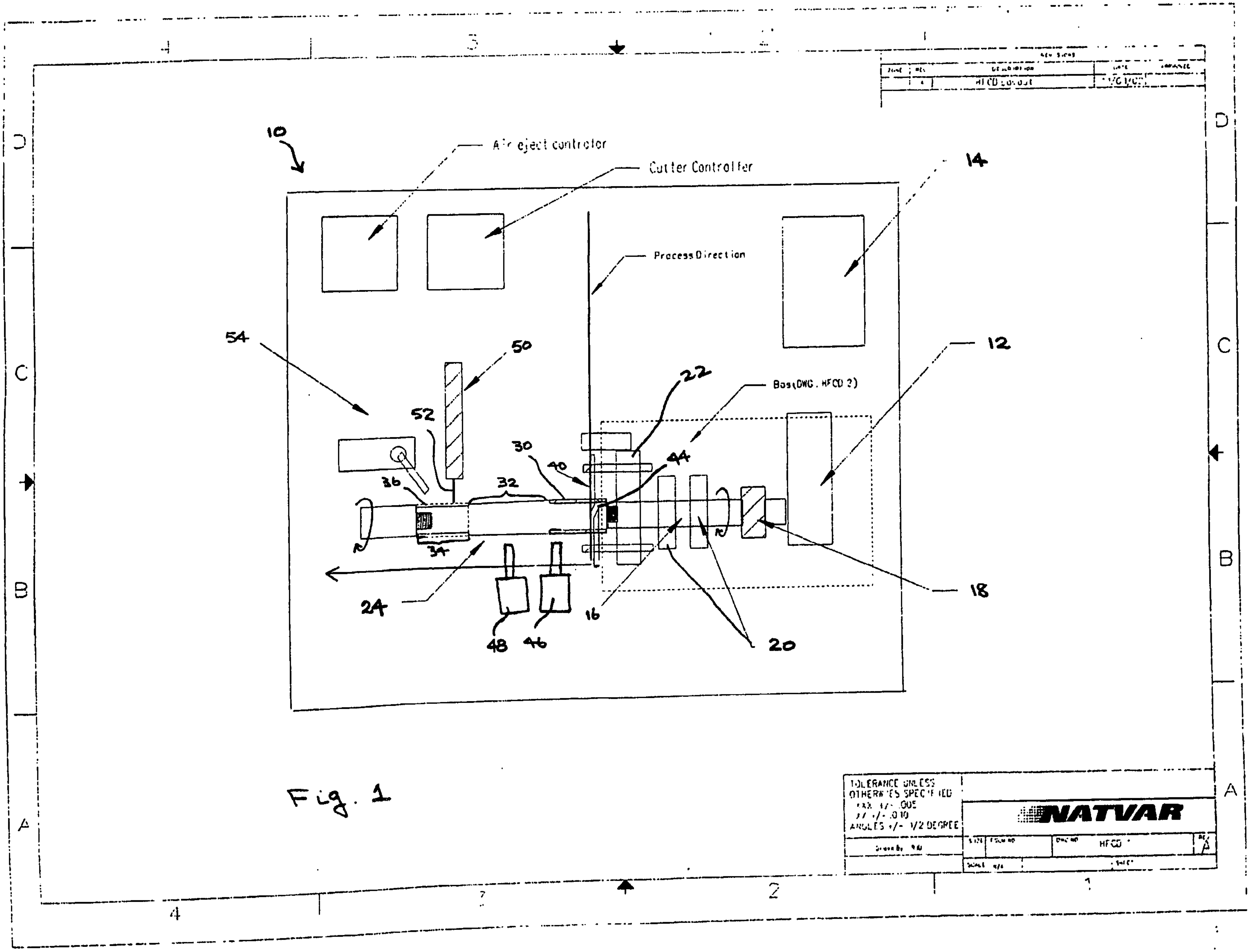
In general, the main tube shaft 24 may have an outer diameter in a range from 0.1 inch to 20.0 inches and larger, although outer diameters in a range from 0.5 inch to 1.0 inch are more commonly used.

The plastic tubing itself may be extruded from any of the materials commonly used by those of ordinary skill in

the art for that purpose. For example, the plastic tubing may be of polymers and copolymers of vinyls, olefins urethanes, such as polyvinyl chloride (PVC), polyethylene (PE), polyurethane (PU), TPE, COPE, ethylene-vinyl acetate (EVA), or may be of multi-layer coextrusions. The tubing may have an inner diameter in a range from 0.005 inch to 1.0 inch and a wall thickness in a range from 0.003 inch to 0.2 inch or more.

The plastic tubing may be coated with a heat-activated adhesive or sprayed with a solvent prior to coiling, so that the coiled tubing produced on the coiling system 10 may have individual coiled turns which are adhered to those adjacent to it.

The main tube shaft 24 and tube guide 40 together give the tubing the proper orientation to achieve a continuously coiling system. In this regard, gap 44, shown in Figure 3B, is oriented at an oblique angle which may vary depending upon the diameter of the shaft and the outer diameter of the plastic tubing being coiled. As stated above, the oblique angle may be 158° in some situations. In any event, the gap 44 is 50 mil wider than the outer diameter of the plastic tubing being coiled.



10
Air eject controller
Cutter Controller
14
Process Direction
54
50
52
12
22
Bos(DWG. HFCD 2)
30
40
44
36
32
34
24
16
18
48
46
20
TOLERANCE UNLESS OTHERWISE SPECIFIED
ANGLES +/- 1/2 DEGREE
NATVAR

Fig. 1

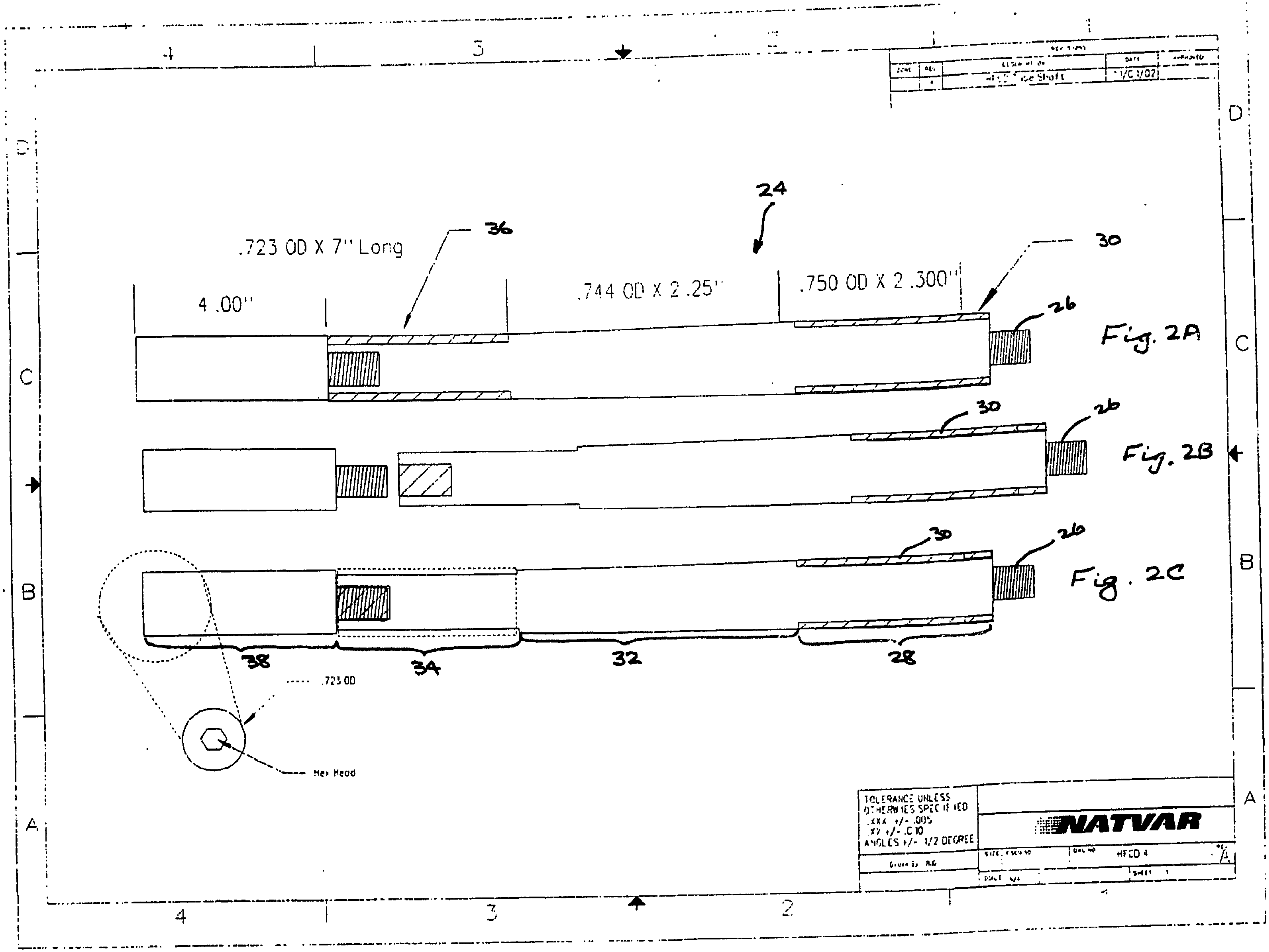


Fig. 2A
Fig. 2B
Fig. 2C

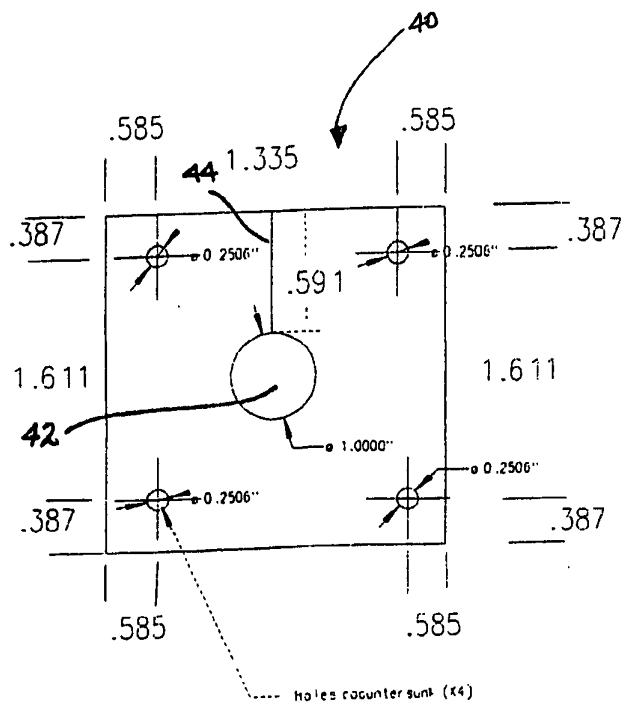


Fig. 3A

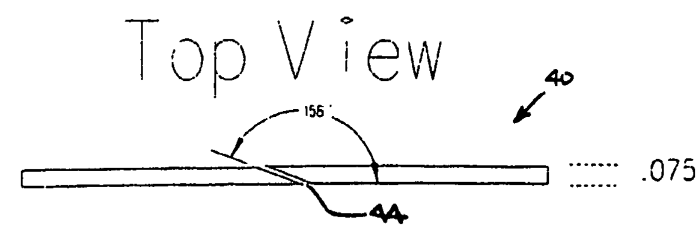


Fig. 3B

HFCD Main Tube Guide

TOLERANCE UNLESS OTHERWISE SPECIFIED
XXX +/- .005
XX +/- .010
ANGLES +/- 1/2 DEGREE

NATVAR

HFCD 3

A

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/US04/032322

International filing date: 01 October 2004 (01.10.2004)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 60/508,024
Filing date: 01 October 2003 (01.10.2003)

Date of receipt at the International Bureau: 12 November 2004 (12.11.2004)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse